WHAT IS CLAIMED IS:

1. A test unit for testing operation and measuring performance of wireless data communication systems and equipment, comprising:

a protocol test unit for generating test stimulus data, executing a sequence of test steps selected for testing operation and measuring performance of said wireless data communication systems, and processing test result data;

a location processor, operatively coupled to said protocol test unit, for generating spatial location data providing the location of said protocol test unit relative to a preset point; and

a first interface unit, operatively coupled to said protocol test unit, for converting said test stimulus data to a first format specific to said object under test and for converting said test result data to a second format specific to said protocol test unit.

2. The test unit as in claim 1, wherein said first interface unit further includes means for forwarding converted test result data to said protocol test unit, and wherein said protocol test unit having means for storing said converted test result data as previously recorded test result data.

3. The test unit as claimed in claim 2, wherein said first interface unit includes means for regenerating said previously recorded test result data to produce additional test stimulus data based on said sequence of test steps selected and said previously recorded test result data.

4. The test unit as claimed in claim 1, further comprising a second interface unit for converting said test result data from said second format to a third format specific to a remote central controller and for converting monitoring and control data received from said remote central controller into said second format.

5. The test unit as claimed in claim 4, wherein said protocol test unit comprises:

means for storing said sequence of test steps and said test result data;

a central processing unit for controlling operation of said protocol test unit according to said monitoring and control data; and

means for operatively connecting said central processing unit with said location processor, said first interface unit and said second interface unit.

6. The test unit as claimed in claim 5, wherein said means for operatively connecting comprises:

a bus control logic for controlling internal data transfer between said central processing unit, said means for storing, said location processor, said first interface unit and said second interface unit; and

a data bus for enabling data transfer between said central processing unit, said means for storing, and said bus control logic.

7. The test unit as claimed in claim 4, wherein said test protocol unit further comprises a synchronization unit for providing a clock reference for said first interface unit.

8. The test unit as claimed in claim 7, wherein said synchronization unit further provides a synchronization input port and a synchronization output port for connection to corresponding synchronization output and input ports on additional test units.

9. The test unit as claimed in claim 5, wherein said means for storing comprises both non-volatile memory for storing said sequence of test steps and a volatile memory for storing said test result data.

10. The test unit as claimed in claim 1, wherein said first interface unit comprises:

an antenna for generating a wireless test stimulus signal and capturing a wireless test result signal over a wireless link;

Radio Frequency (RF) front-end means for formatting a serial sequence of test stimulus data into said wireless test stimulus signal and transmitting said wireless test stimulus signal on said wireless link, and also for receiving said wireless test result signal and formatting same into a serial sequence of test result data; and

means for converting said test stimulus data into said serial sequence of test stimulus data and converting said serial sequence of test result data into said serial sequence of test result data.

11. The test unit as claimed in claim 10, wherein said RF front-end means further comprises means for controlling the transmit power level of said wireless test stimulus signal in accordance with said sequence of test steps executed by said protocol test unit.

12. The test unit as claimed in claim 10, wherein said RF front-end means further comprises means for controlling the receiver detection threshold of said wireless test results signal in accordance with said sequence of test steps executed by said protocol test unit.

13. The test unit as claimed in claim 10, wherein said RF front-end means further comprises means for controlling the transmit power level of said wireless test stimulus signal in accordance with said sequence of test steps executed by said protocol test unit.

14. The test unit as claimed in claim 10, wherein said first interface means comprises a channel simulator, operatively coupled between said antenna and said RF front-end means, for emulating physical characteristics of said wireless link.

15. The test unit as claimed in claim 10, wherein said means for converting comprises:

a serial to parallel converter for converting n consecutive bits of said sequence of test result data into an n-bit receive word;

means for formatting said receive words into said test results data and separating said test stimulus data into transmit words;

a parallel to serial converter for converting each said transmit word into n consecutive bits; and

an RF interface for transmitting said test results data to said protocol test unit, and for receiving said test stimulus data from said protocol test unit.

16. The test unit as claimed in claim 15, wherein said means for formatting comprises:

a master clock for providing an accurate time indication;

means for establishing the beginning and the end of each said receive word based on said time indication; and

means for determining the beginning and the end of each transmit word based on said time indication.

17. The test unit as claimed in claim 16, further comprising means for adding and subtracting an adjustable offset delay to said accurate time indication in accordance with said sequence of test steps executed by said protocol test unit.

18. The test unit as claimed in claim 1, wherein said location processor comprises:

a location antenna for receiving a location signal according to a specified wireless protocol;

a location front-end unit for processing said location signal in conformity with said wireless protocol;

a baseband processor for converting said location signal into said spatial location data; and

a location interface to said protocol test unit.

19. The test unit as claimed in claim 18, wherein said specified wireless protocol is GPS, and wherein said spatial location signal is a satellite navigation signal.

20. The test unit as claimed in claim 4, wherein said third format used by said second interface unit is Ethernet.

21. The test unit as claimed in claim 20, wherein said second interface unit comprises:

an Ethernet medium access control (MAC) logic unit for performing Ethernet frame processing and MAC functions on said monitoring and control data and said test results data;

an Ethernet physical layer device (PHY) logic unit for implementing Ethernet physical layer functions required to interface said communication interface unit with said central controller; and

a communication interface to said protocol test unit.

22. The test unit as claimed in claim 4, wherein said third format used by said second interface unit is a radio data link.

23. The test unit as claimed in claim 22, wherein said second interface unit comprises:

an antenna coupled to a transmit/receive switch unit, for transmitting said test results data and for receiving said monitoring and control data over said radio data link;

a serial transmitter/receiver for modulating said test results data and respectively detecting said monitoring and control data in a serial format;

a bi-directional UHF serializer-deserializer processor for converting the format of said test results data and said monitoring and control data between said serial format required over said radio data link and a parallel format required by said protocol test unit;

a clock generator for generating a carrier frequency signal for modulating /said receiver and said transmitter; and

a communication interface to said protocol test unit.

24. A test system for testing operation and measuring performance of wireless data communication systems and equipment, comprising:

n test units, each test unit for selectively testing a specific parameter and data protocol pertinent to an object under test, where *n* is an integer $n \in [1, N]$;

a location processor on each said test units for determining the location of each said test unit relative to a pre-set point;

a central controller for monitoring, controlling and coordinating operation of said test units and collecting test results data associated with said respective spatial location data; and

a user interface for enabling selection of test sequences, configuration of traffic generation and of test parameters.

25. The test system as claimed in claim 24, wherein said *n* test units are collectively adapted at their physical layer such that said *n* test units are capable of further testing, in parallel, at least one additional object under test.

26. The test system as claimed in claim 24, wherein each said test unit operates as one of a wireless LAN (WLAN) access point, a WLAN endstation, and a traffic monitor for said object under test.

27. The test system as claimed in claim 24, wherein any of said test units is connected to said central controller over an Ethernet link.

28. The test system as claimed in claim 24, wherein any of said test units is connected to said object under test over a wireless link.

29. A method of testing operation and measuring performance of wireless data communication systems and equipment, comprising:

a) providing *n* test units in the proximity of an object under test and connecting said test units to a central controller, where *n* in an integer $n \in [1, N]$;

b) initializing a connection between said test units and said central controller;

c) configuring, at each said test unit, traffic generation, a test sequence, and a set of reporting parameters according to said test sequence;

d) operatively controlling said test units for executing said test sequence;

e) collecting test result data at said test units and associating said test result data with a respective test unit; and

f) organizing, reviewing and analyzing said test result data.

30. The method as claimed in claim 29, wherein said steps b) through e) are initiated from said central controller.

31. The method as claimed in claim 29, wherein said step b) comprises:

b1) identifying said *n* test units connected to said central controller and configuring a set of test units, within said *n* test units, for executing said test sequence;

b2) time-synchronizing said set of test units by exchanging timing signals between said set of test units to bring a clock reference generated by said set of test units into synchronism with a master clock of said *n* test units; and

b3) determining the spatial position of each of said set of test units in relation to said central controller.

32. The method as claimed in claim 31, wherein said step b3) is implemented using the Global Positioning System (GPS) to determine the absolute three-dimensional spatial co-ordinates of each respective test unit.

33. The method as claimed in claim 32, further comprising improving location accuracy for said test units by providing differential GPS (DGPS) corrections to said spatial position.

34. The method as claimed in claim 31, wherein step b) further comprises providing firmware upgrades to said test units from said central controller.

35. The method as claimed in claim 29, wherein said step c) comprises:

c1) initializing a first interface unit for establishing a wireless link between each said test unit and said object under test for enabling execution of said test sequence;

c2) configuring traffic patterns and monitoring parameters to be used during execution of said test sequence; and

c3) defining reporting options for test results to be sent back to said central controller.

36. The method as claimed in claim 35, wherein said step c1) comprises writing operational parameters for said wireless link into a plurality of registers of said first interface unit, including a data rate, a preamble length, a respective scrambler seeds, antenna selection controls, tone generation, and receiver automatic gain control (AGC) control.

37. The method as claimed in claim 35, wherein step c1) comprises initializing said first interface unit in each said test unit with a relative offset delay, such that said test sequence executed on any one of said test units is adjustably offset in time relative to said test sequence executed on any other of said test units.

38. The method as claimed in claim 37, wherein said relative offset delay is used to emulate the effect of increasing or decreasing the relative distance between said test units and said object under test.

39. The method as claimed in claim 35, wherein said step c2) comprises configuring traffic monitoring parameters and configuring traffic generation parameters for determining the nature of traffic to be transmitted by the test units.

40. The method as claimed in claim 39, wherein said traffic monitoring parameters include error filters, frame capture filters, event filters and counter update controls.

41. The method as claimed in claim 39, wherein said traffic generation parameters include frame data values, data payload patterns, error injection parameters, traffic stream parameters and test sequence scripts.

42. The method as claimed in claim 36, wherein said traffic generation parameters include transmit power level values.

43. The method as claimed in claim 42, wherein said transmit power level values are adjusted to emulate the effect of adjusting a relative distance between said test units and said object under test.

44. The method as claimed in claim 42, wherein said transmit power level values are adjusted to emulate an effect of adjusting relative attenuation properties of said wireless link established between said test units and said object under test.

45. The method as claimed in claim 39, wherein said traffic monitoring parameters include receiver detection threshold values.

46. The method as claimed in claim 45, wherein said receiver detection threshold values are adjusted to emulate an effect of adjusting a relative distance between said test units and said object under test.

47. The method as claimed in claim 46, wherein said receiver detection threshold values are adjusted to emulate an effect of adjusting relative attenuation properties of said wireless link established between said test units and said object under test.

48. The method as claimed in claim 39, wherein said step c3) includes providing pattern-matching filters for defining a type of statistics of interest for said test sequence, types of frames captured and reported during said test sequence, and fields within said captured types of frames that are stored.

49. The method as claimed in claim 29, wherein said step d) comprises, at each said test unit,

d1) generating traffic for stimulating said object under test;

d2) monitoring the traffic between said object under test and said test unit in real-time; and

d3) recording, at said respective test unit, test responses received from said object under test.

50. The method as claimed in claim 49, wherein said step d1) comprises generating traffic by processing said test responses recorded during said step d3) at an earlier time for a given instance of said test unit.

51. The method as claimed in claim 49, wherein said step d1) comprises generating wireless data traffic including specific frame sequences used to test operation and protocol compliance of said object under test, continuously generating traffic to measure a system throughput, and generating illegal data to test a level of robustness of said object under test.

52. The method as claimed in claim 49, wherein said step d3) comprises real-time capturing and recording of: events, wireless data frames selected according to filters defined during step c), interface-dependent parameters associated with said captured wireless data frames, error parameters associated with said captured wireless data frames.

53. The method as claimed in claim 52, wherein said step d3) comprises further real-time capturing and recording of: predefined minimum and maximum variables for determining various extremes pertaining to the transmitted and received traffic streams, user-defined auxiliary minimum and maximum variables that record a minimum and

maximum time interval between any two types of user-selectable packet filters, and tables that record wireless data frame fields, including addresses, that are associated with said received traffic.

54. The method as claimed in claim 49, wherein said step d3) comprises predefining statistics counters for capturing and accumulating counts of different events, counts a number of frames matching a set of user-configured filter parameters, and counts of a number of frame octets corresponding to said matching number frames.

55. The method as claimed in claim 29, wherein said test result data are associated with a timestamp for indicating modification of said test result data.

56. A test system for testing operation and measuring performance of wireless data communication systems having both a wireless network portion and a wired network portion, comprising:

n test units, each test unit for selectively testing a specific parameter and data protocol pertinent to an object under test in said wireless data communication systems, where *n* is an integer $n \in [1, N]$;

a location processor on each said test units for determining the location of each said test unit relative to a pre-set point;

a central controller for monitoring, controlling and coordinating operation of said test units and collecting test results data associated with said respective spatial location data; and

a user interface for enabling selection of test sequences, configuration of traffic generation and of test parameters;

wherein at least one of said *n* test units includes a wireless network interface unit for testing a wireless object in said wireless network portion, and

wherein at least one of said *n* test units includes a wired network interface unit for testing a wired object in said wireless network portion.